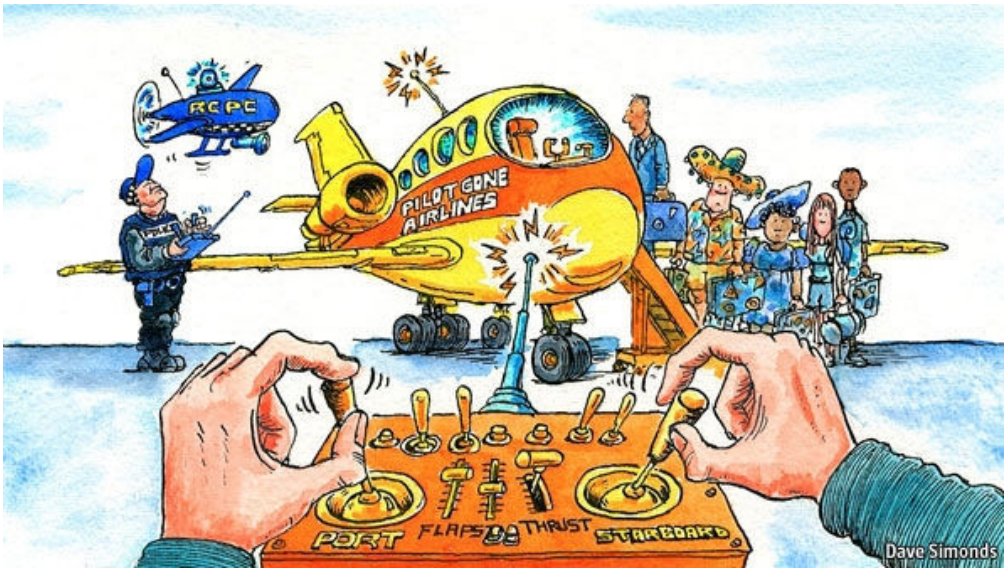
The Economist

Pilotless aircraft

This is your ground pilot speaking

Autonomous civil aircraft could be flying before cars go driverless

Nov 24th 2012 | from the print edition



WITHIN the next few weeks a twin-engined Jetstream will take off from Warton Aerodrome in Lancashire, England, and head north towards Scotland. Like any other flight, the small commuter airliner will respond to instructions from air-traffic controllers, navigate a path and take care to avoid other aircraft. But the pilot flying the aircraft will not be in the cockpit: he will have his feet firmly on the ground in a control room back at Warton.

Pilotless aircraft are now widely used by the armed forces, but those drones fly only in restricted airspace and conflict zones. The Jetstream mission is part of a project to develop the technologies and procedures that will allow large commercial aircraft to operate routinely and safely without pilots in the same skies as manned civilian flights.

Fasten your seat belts

To reassure those of a nervous disposition, the test flights do not carry passengers and pilots remain in the cockpit just in case things go wrong. In that way they are similar to Google's trials of driverless cars, which have drivers inside them to take over if necessary while on public roads. Yet unmanned commercial aircraft are likely to enter service before people can buy autonomous cars. Modern aircraft are already perfectly capable of automatically taking off, flying to a destination and landing. These tests are trying to establish whether they can do those things safely without a pilot in the cockpit and at the same time comply with the rules of the air.

Progress is being made, a conference in London heard this week. It was organised by the Autonomous Systems Technology Related Airborne Evaluation and Assessment (ASTRAEA), the group staging the British test flights. This £62m ($99m) programme, backed by the British government, involves seven European aerospace companies: AOS, BAE Systems, Cassidian, Cobham, QinetiQ, Rolls-Royce and Thales.

It is potentially a huge new market. America's aviation regulators have been asked by Congress to integrate unmanned aircraft into the air-traffic control system as early as 2015. Some small drones are already used in commercial applications, such as aerial photography, but in most countries they are confined to flying within sight of their ground pilot, much like radio-controlled model aircraft. Bigger aircraft would be capable of flying farther and doing a lot more things.

Pilotless aircraft could carry out many jobs at a lower cost than manned aircraft and helicopters—tasks such as traffic monitoring, border patrols, police surveillance and checking power lines. They could also operate in conditions that are dangerous for pilots, including monitoring forest fires or nuclear-power accidents. And they could fly extended missions for search and rescue, environmental monitoring or even provide temporary airborne Wi-Fi and mobile-phone services. Some analysts think the global civilian market for unmanned aircraft and services could be worth more than $50 billion by 2020.

Whatever happens, pilots will still have a role in aviation, although not necessarily in the cockpit. "As far as the eye can see there will always be a pilot in command of an aircraft," says Lambert Dopping-Hepenstal, the director of ASTRAEA. But that pilot may be on the ground and he may be looking after more than one unmanned aircraft at the same time.

Commercial flights carrying freight and express parcels might one day also lose their on-board pilots. But would even the most penny-pinching

cut-price airline be able to sell tickets to passengers on flights that have an empty cockpit? More realistically, those flights might have just one pilot in the future. Technology has already relieved the flight deck of a number of jobs. Many early large aircraft had a crew of five: two pilots, a flight engineer, a navigator and a radio operator. First the radio operator went, then the navigator, and by the time the jet era was well under way in the 1970s flight engineers began to disappear too. Next it could be the co-pilot, replaced by the autonomous flight systems now being developed.

The flight over Scotland will test how well air-traffic controllers can communicate with the ground pilot through the aircraft. The project is also exploring ways to make the radio and satellite links secure and reliable. But engineers still have to prepare for the eventuality that the link breaks; the aircraft then has to have enough autonomy to operate safely until communications are restored or it can land using its own guidance systems.

Unmanned aircraft will, therefore, need a "sense and avoid" capability. This can be provided by transponders that bleep the aircraft's presence (and, in the case of advanced systems, its course, altitude and speed) to other aeroplanes and air-traffic controllers. But not all manned aircraft have such kit. Some light aircraft and gliders operating at low altitudes in clear weather are not required to have even radios, let alone transponders or radar. Which is why pilots keep their eyes peeled when such traffic might be about.

ASTRAEA's Jetstream, therefore, also uses video cameras to allow the ground pilot to look around outside the cockpit. Image-recognition software can warn of other aircraft. This is being tested against different backgrounds, such as a cluttered landscape or a hazy sky.

In other trials, different aircraft are being flown in the vicinity of the Jetstream, and some of them will be flown deliberately towards it on a potential collision course, to see if these "intruding" aircraft can be recognised by the automated systems and the appropriate avoiding action taken. These flights are taking place in an area cleared of other aircraft over the Irish Sea. "The results to date suggest you can do sense-and-avoid as well as a human," says Mr Dopping-Hepenstal.

A pilotless plane must also be able to act autonomously in an emergency. In the event of an engine failure, for instance, it could use its navigational map to locate a suitable area to put down. But what if this was an open field that happened to be in use for, say, a fair? A forward-looking video camera might show a ground pilot that. But if

communications were lost the aircraft would rely on image-recognition software and an infra-red camera to detect the heat given off by people and machines and so decide to try to land elsewhere.

The ASTRAEA researchers are carrying out a lot of their work using flight simulators and air-traffic-control data. But eventually they will still have to prove that their systems can work in the real world—even during emergency landings. In order to satisfy risk-averse aviation regulators, the researchers are working with Britain's Civil Aviation Authority to certify a virtual pilotless aircraft for use in civil airspace. The intention is not to certify an actual aircraft, but for both sides to learn what will be required to do so.

Some of the technologies being developed are also likely to find their way into manned aircraft as a backup for pilots, and possibly for cars too. Systems that provide automatic braking and motorway-lane control, for instance, already feature in many types of car. These features take cars some of the way towards autonomy. But driverless cars, like pilotless planes, will have to fit in with existing infrastructure and regulations, not least insurance liability, before they can take off.

from the print edition | Science and technology